Assessment of the Occurrence of Cancer
East Harris County, Texas
1995–2012
June 19, 2015

Prepared by the
Texas Department of State Health Services

Investigation# 14004

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Executive Summary

Citizen concern prompted the Environmental and Injury Epidemiology and Toxicology Unit (EIET) and Texas Cancer Registry (TCR) of the Texas Department of State Health Services (DSHS) to examine the occurrence of cancer in east Harris County, Texas.

DSHS followed the Centers for Disease Control and Prevention (CDC) and Council of State and Territorial Epidemiologists (CSTE) 2013 guidelines to investigate the occurrence of 17 types of childhood and adult cancers in a geographic area selected in collaboration with community members. In accordance with these guidelines, the purpose of this assessment was to determine whether the observed number of cancer cases is statistically significantly greater than expected. It was not intended to determine the cause of the observed cancers or identify possible associations with any risk factors.

DSHS staff analyzed TCR data available for an 18-year period spanning from 1995 to 2012. United States Census data was used to estimate the population in the selected geographic area, which consisted of 38 census tracts. To evaluate the occurrence of cancer in the area investigated, the number of observed cancer cases was compared to what would be expected for the area based on cancer rates in Texas. Standardized incidence ratios (SIRs) were calculated as the number of observed cases divided by the number of expected cases in the area of concern for the 18-year period (1995-2012). A 95 percent confidence interval (CI) was calculated for each SIR to determine statistical significance.

Observed numbers of several of the 17 cancers analyzed were statistically significantly greater than expected, while others were statistically significantly less than expected. In accordance with the CDC and CSTE 2013 guidelines, DSHS will review these results with a group of subject matter experts to assess the feasibility of follow-up epidemiologic study.

Background

Citizen concern expressed to the Texas Department of State Health Services (DSHS) prompted the agency's Environmental and Injury Epidemiology and Toxicology Unit (EIET) and Texas Cancer Registry (TCR) to examine the occurrence of cancer in east Harris County, Texas. Local residents were concerned about a possible excess of cancer cases occurring in the flood plain around the San Jacinto River, which includes the San Jacinto River Waste Pits (SJRWP) Superfund site.

The Centers for Disease Control and Prevention (CDC) and Council of State and Territorial Epidemiologists (CSTE) define a cancer cluster as a greater than expected number of cancer cases that occurs within a group of people in a geographic area over a defined period of time[1]. DSHS followed the CDC and CSTE 2013 Guidelines for Investigating Suspected Cancer Clusters and Responding to Community Concerns[1] to investigate the occurrence of cancer in this community.

The CDC and CSTE guidelines include four steps[1]. The first step is to collect information about the community's concerns. The second step, reported here, is to determine whether the observed number of cancer cases is statistically significantly greater than expected. It is important to note that the data and statistical analysis conducted at this step cannot determine if cancers observed in the community are associated with environmental, lifestyle, or other risk factors.

The guidelines also provide additional steps that can be followed when appropriate. The third step is to evaluate the feasibility of performing an epidemiologic study to examine if exposure to a specific risk factor is associated with the suspected cancer cluster, and the fourth step is to conduct an epidemiologic study, if deemed feasible in step three. Many factors are considered in making the determination to progress to steps three or four. The CDC and CSTE guidelines state, "only a small fraction of cancer cluster inquiries might meet the statistical and etiological criteria to support a cluster investigation through all the steps outlined…."[1]

Methods

Consistent with the CDC and CSTE guidelines, DSHS collaborated with the community to select the geographic area, time frame, and cancers to be included in this analysis.

The following cancer types were included in the analysis: childhood leukemia, lymphoma, kidney (renal), liver (hepatic), brain cancers, glioma (a brain cancer subtype), melanoma, and retinoblastoma; and all-ages leukemia, lymphoma, myeloma, kidney (renal), liver (hepatic), brain, breast, cervical, and thyroid cancers.

Complete TCR cancer data are available for 1995 to 2012. DSHS evaluated all 18 years of available cancer data because the community was concerned about cancers occurring during the entire time period.

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[1] Centers for Disease Control and Prevention, *Investigating Suspected Cancer Clusters and Responding to Community Concerns.* MMWR, 2013. 62: p. 22.

The geographic area investigated is consistent with the San Jacinto River surge inundation zones[2] identified by the Environmental Protection Agency (EPA)[3]. It also includes neighborhoods identified in a 2013 Public Health Assessment conducted by DSHS, which considered the areas investigated by the EPA[4]. The 38 census tracts comprising the area investigated are shown in Figure 1.

This document outlines the results from step two of the CDC and CSTE guidelines, and only addresses the question, "Is there a statistically significant excess of cancer in the area of investigation?"

Data Sources

For each cancer type, the number of cases observed from 1995 to 2012 in the area included in the investigation was obtained from the TCR (Incidence – Texas, 1995-2012, SEER*Prep 2.5.2). The TCR is responsible for the collection, maintenance, and dissemination of high-quality Texas population-based cancer data, and meets national CDC timeliness and data quality standards, as well as North American Association of Central Cancer Registry certification standards. Childhood cancers (those occurring among individuals ages 0 to 15 years) were defined according to the International Classification of Childhood Cancer[5]. Statewide cancer rates for the same time period were also obtained from the TCR.

Population estimates for 1995 to 2012 were calculated using linear interpolation based on population counts obtained from the United States Decennial Census[6] for the years 1990, 2000, and 2010. This method, outlined by the United States Census Bureau[7], assumed population growth occurred in a linear manner.

Statistical Analysis

To determine if a statistically significant excess of cancer existed in the area investigated, the number of observed cancer cases was compared to what would be expected for the area based on cancer rates in Texas. Characteristics such as race, sex, and age are closely related to cancer. To ensure that differences between the numbers of observed and expected cancer cases are not simply due to differences in these demographic characteristics, the expected numbers of cancer cases were calculated by multiplying the age-, sex-, and race-specific cancer incidence rates of

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[2] Brody, S, Blessing R, Atoba K, Mobley W, and Wilson M, *A Flood Risk Assessment of the San Jacinto River Waste Pit Superfund Site*. 2014, Center for Texas Beaches and Shores: Texas A&M University Galveston.

[3] Environmental Protection Agency. *San Jacinto River Waste Pits*. January 2015; Available from: http://www.epa.gov/region6/6sf/pdffiles/san-jacinto-tx.pdf.

[4] Texas Department of State Health Services, Environmental & Injury and Toxicology Branch, and Agency for Toxic Substances and Disease Registry, *Public Health Assessment, San Jacinto River Waste Pits*. 2013, EPA Facility ID: TXN000606611: Channelview, Harris County, TX.

[5] Steliarova-Foucher E, Stiller C, Lacour B, and Kaatsch P, *International Classification of Childhood Cancer, third edition.* Cancer, 2005. 103(7): p. 1457-1467.

[6] United States Census Bureau. *American FactFinder*. 2012; Available from: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

[7] US Census Bureau. *Methodology for the Intercensal Population and Housing Unit Estimates: 2000 to 2010*. 2012; Available from: http://www.census.gov/popest/methodology/2000-2010_Intercensal_Estimates_Methodology.pdf.

Texas residents (reference population) by the number of people in the corresponding demographic groups in the area of investigation.

Standardized incidence ratios (SIRs) were calculated to determine if an excess of cancer exists in the area. The SIR is the number of observed cases compared to (divided by) the number of expected cases for each cancer type. A SIR greater than 1.00 indicates that the observed number of cases of a specific cancer type is higher than expected and a SIR less than 1.00 indicates that the observed number of cases of a specific cancer type is lower than expected.

Few, if any, communities will have exactly the same rate as the average state rate for a similar population; most will be higher or lower. Therefore, 95 percent confidence intervals (CI) were calculated for the SIRs to determine if the observed number of cases was statistically significantly different than expected. If a 95 percent CI (range) includes 1.00, no statistically significant excess (or reduction) of cancer is indicated. If a 95 percent CI does not contain 1.00, the SIR is outside the expected range and is statistically significant. When using a 95 percent CI, 5 percent of SIR values calculated is expected to be statistically significantly higher or lower than the state average due to random chance alone.

In all cases, when results are described as significant or not significant, DSHS is referring only to statistical significance, with the understanding that all cases of cancer are significant to the individual, the family, and friends of the individuals who are affected.

Results

Table 1 presents the number of observed cases, the number of expected cases, the SIRs, and the corresponding 95 percent CIs for each cancer type evaluated in the area with all census tracts analyzed together. The number of childhood lymphoma and melanoma cases observed in the area investigated was statistically significantly higher than expected. The number of brain and cervical cancers among all ages was statistically significantly higher than expected. The number of thyroid cancers for all ages was statistically significantly lower than expected.

SIRs and 95 percent CIs were also calculated for each census tract separately. Table 2 presents the number of observed cases, the number of expected cases, the SIRs, and the corresponding 95 percent CIs for each individual census tract. For each of these census tracts, only cancers with a significantly higher or lower than expected number are shown. Non-significant results were not included in Table 2.

- The number of childhood brain cancer, leukemia, melanoma, and glioma cases were statistically significantly higher than expected in census tracts 2519, 2323, 2330, and 2520, respectively.
- The number of childhood retinoblastoma cases was statistically significantly higher than expected in census tracts 2328 and 2529.
- The number of male breast cancer, kidney cancer, and leukemia cases among all ages were each statistically significantly higher in 1 of the 38 census tracts.
- The number of liver, brain, and cervical cancer cases among all ages was statistically significantly higher than expected in two, three, and five census tracts, respectively.

- The number of both lymphoma and myeloma cases were statistically significantly higher in one, and statistically significantly lower in another, of the census tracts.
- The number of female breast cancer cases was statistically significantly higher in three, and statistically significantly lower in eight of the census tracts.

Discussion

Consistent with the second step of the CDC and CSTE guidelines for investigating suspected cancer clusters, the primary purpose of this step (assessment) is to determine whether the observed number of cases is statistically significantly greater than expected[1]. It is not intended to determine the cause of the observed cancers or identify possible associations with any risk factors.

The assessment step in a cancer cluster investigation has several inherent limitations, and results should be interpreted with these limitations in mind. Cancer is not a single disease, but rather many different diseases. Different types of cancers vary in etiologies (causes or origins) and may not share the same predisposing factors. Cancers may be associated with a variety of factors such as genetics, lifestyle, and socioeconomic status. Because cancer is common, cases might appear to occur with alarming frequencies within a community even when the number of cases is within the expected rate for the population.

Additionally, cancer incidence data are based on residence at the time of diagnosis. As people move, it becomes more difficult to determine whether living in the area of investigation is associated with an excess of cancers, because residential history is not tracked. Latency (the time period elapsed between exposure and illness onset) adds to the complexity of this step in the investigation. For most adult cancers, a period of 10 to 40 years can elapse between the beginning of an exposure to a cancer-causing agent and the development of a clinically diagnosable case of cancer. It is possible that former residents who developed cancer no longer lived in the area at the time of diagnosis, and these cases would not be included in this assessment. It is also possible that new people have moved into the area and then were diagnosed with cancer; these cases are included in this assessment.

For this assessment, DSHS analyzed cancer incidence for both the 38 census tracts together and for each of the census tracts separately, as requested by the community. However, the results of the individual census tract analyses should be interpreted with caution. The numbers of observed and expected cases for some of the cancer types were small. SIRs based on small numbers often yield wide confidence intervals, which reduces the reliability of SIR estimates.

Furthermore, the validity of these census tract-level analyses was limited by the statistical issue of multiple comparisons. Evaluation of 17 different types of cancers for 38 individual census tracts resulted in 646 census tract-level SIR estimates. Since a 95 percent confidence interval was used, 5 percent of estimates (32 of the 646 SIRs calculated) may be statistically significant due to chance alone, not because of a true excess of cancers.

Conclusion

This assessment identified a number of statistically significant results that warrant further discussion. In particular, the SIRs for childhood glioma in census tract 2520, childhood melanoma in census tract 2330, and childhood retinoblastoma in census tracts 2328 and 2529 are

notable. Childhood cancers are rare and have shorter latency periods. However, the limitations mentioned above must be taken into account when interpreting these results. The SIR estimates for each of these three childhood cancers were based upon very small numbers of cases observed over a long period of time (18 years). As mentioned above, reliability is reduced for estimates based on small numbers, even if the SIRs are large. An additional limitation of the childhood melanoma analysis is the under-reporting of these cases to the TCR. Melanoma diagnoses and treatment often occurs in an outpatient setting, where automated surveillance systems usually do not exist. Incomplete data could lead to biased and misleading results.

Recommendations and Next Steps

In keeping with the CDC and CSTE guidelines, DSHS will consult with a group of subject matter experts to review statistically significant cancers identified in this assessment (especially the rare childhood cancers with large SIR estimates) and evaluate whether follow-up epidemiologic study is recommended and feasible. This group will include internal and external experts in epidemiology, oncology, and toxicology, as well as a citizen to represent the community's interests.

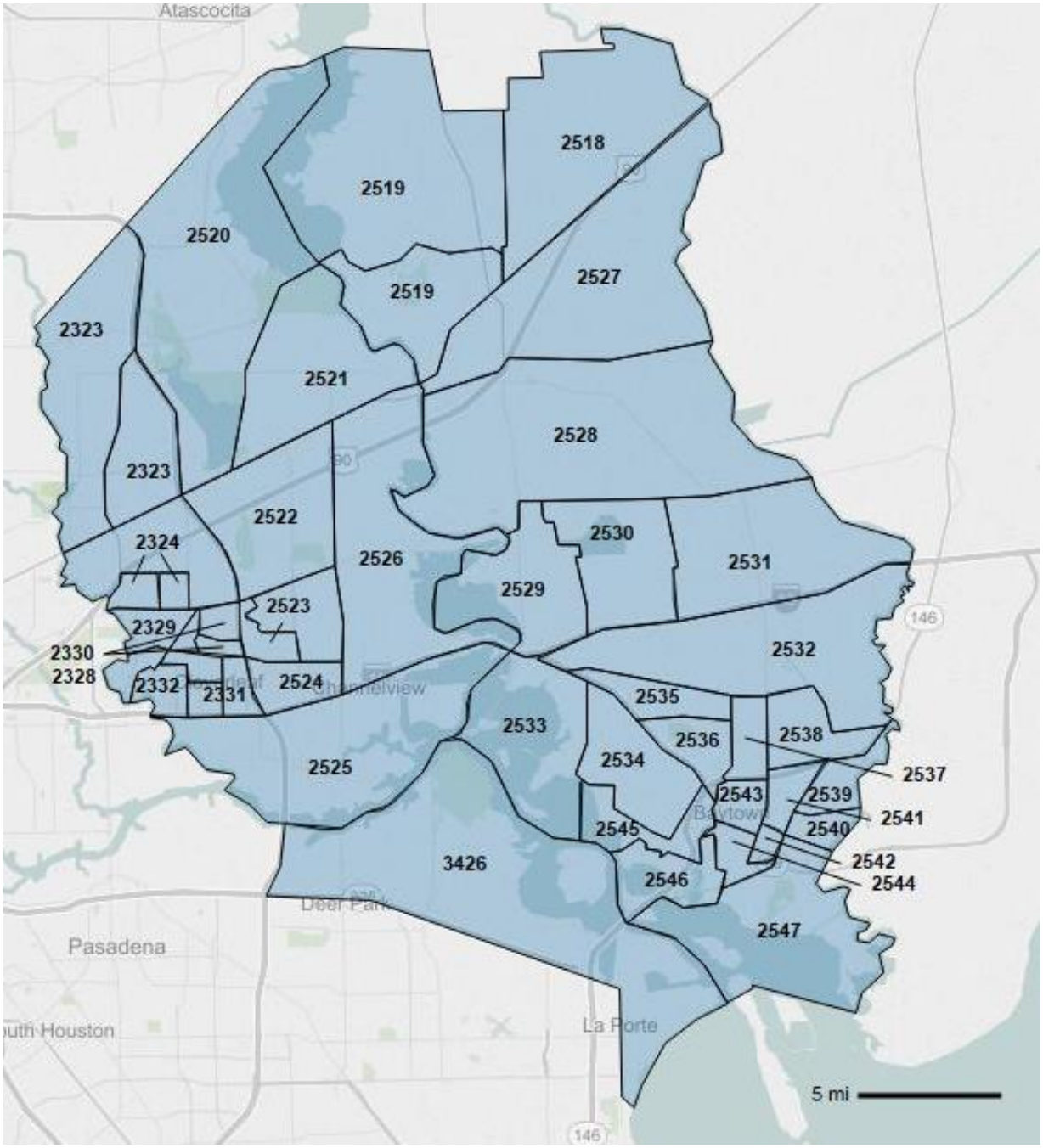
Additional Information

For additional information about cancer clusters, visit the Centers for Disease Control and Prevention, "About Cancer Clusters," web page at http://www.cdc.gov/nceh/clusters/about.htm.

For additional information on cancer risk factors, visit the American Cancer Society, "What Causes Cancer?" web page at http://www.cancer.org/cancer/cancercauses/index.

Questions or comments regarding this investigation may be directed to Emily Hall, MPH, Epidemiologist, Environmental & Injury Epidemiology & Toxicology Unit, at 512-776-3723 (email: emily.hall@dshs.state.tx.us) or to Leticia Nogueira, PhD, MPH, Epidemiology Manager, Cancer Epidemiology and Surveillance Branch at 512-776-3422 (email: leticia.nogueira@dshs.state.tx.us).

Figure 1. Selected Census Tracts (2000) for East Harris County.



Note: Some census tracts were subdivided in the 2010 census; these subdivision boundaries are shown.

Table 1. Standardized Incidence Ratios (SIRs) and 95 percent Confidence Intervals (CIs) for Selected Cancers in 38 East Harris County Census Tracts Analyzed Together, 1995–2012.

Cancer Type	Observed‡	Expected‡	SIR	95% CI
Childhood				
Brain	55	52.7	1.04	(0.79, 1.36)
Glioma	10	7.7	1.30	(0.62, 2.38)
Leukemia	59	67.0	0.88	(0.67, 1.14)
Lymphoma	44	30.3	1.45	(1.05, 1.95)*
Melanoma	13	5.4	2.41	(1.28, 4.11)*
Hepatic	≤5	<1	1.00	(0.21, 2.95)
Renal	10	9.0	1.11	(0.53, 2.04)
Retinoblastoma	8	4.8	1.66	(0.72, 3.27)
All Ages				
Brain	232	200.2	1.16	(1.01, 1.32)*
Female Breast	1917	1939.9	0.99	(0.94, 1.03)
Male Breast	19	13.6	1.39	(0.84, 2.18)
Cervix	226	185.6	1.22	(1.06, 1.39)*
Kidney	491	481.4	1.02	(0.93, 1.11)
Leukemia	441	413.6	1.07	(0.97, 1.17)
Liver	253	223.8	1.13	(1.00, 1.28)
Lymphoma	651	632.9	1.03	(0.95, 1.11)
Myeloma	191	186.3	1.03	(0.89, 1.18)
Thyroid	262	305.8	0.86	(0.76, 0.97)†

*Indicates observed number of cancer cases is statistically significantly **higher** than expected
†Indicates observed number of cancer cases is statistically significantly **lower** than expected
‡For observed case counts less than five, numbers have been suppressed to protect confidentiality

Table 2. Statistically Significant Standardized Incidence Ratios (SIRs) and 95 percent Confidence Intervals (CIs) for Selected Cancers in East Harris County by Census Tract, 1995–2012.

Cancer Type	Census Tract	Observed‡	Expected‡	SIR	95% CI
Childhood					
Brain	2519	7	2.8	2.52	(1.01, 5.19)*
Leukemia	2323	10	4.6	2.17	(1.04, 3.99)*
Glioma	2520	≤5	<1.0	9.29	(1.12, 33.55)*
Melanoma	2330	≤5	<1.0	8.48	(1.02, 30.62)*
Retinoblastoma	2328	≤5	<1.0	14.35	(1.74, 51.83)*
	2529	≤5	<1.0	16.40	(1.99, 59.26)*
All Ages					
Brain	2330	18	9.3	1.94	(1.15, 3.07)*
	2519	23	13.5	1.71	(1.08, 2.57)*
	2533	10	4.8	2.10	(1.01, 3.86)*
Female Breast	2323	72	91.3	0.79	(0.62, 0.99) †
	2328	21	34.8	0.60	(0.37, 0.92) †
	2331	61	85.6	0.71	(0.55, 0.92) †
	2528	77	60.1	1.28	(1.01, 1.60)*
	2534	9	17.9	0.50	(0.23, 0.95) †
	2538	78	60.5	1.29	(1.02, 1.61)*
	2546	23	35.8	0.64	(0.41, 0.96) †
	2547	33	22.0	1.50	(1.03, 2.11)*
	3426	8	22.7	0.35	(0.15, 0.69) †
Male Breast	2523	≤5	<1.0	5.08	(1.05, 14.85)*
Cervix	2330	19	9.2	2.06	(1.24, 3.22)*
	2518	7	1.5	4.81	(1.93, 9.91)*
	2525	8	3.3	2.43	(1.05, 4.80)*
	2529	13	6.4	2.02	(1.07, 3.45)*
	2534	≤5	<1.0	3.91	(1.27, 9.13)*
Kidney	2529	33	21.2	1.55	(1.07, 2.18)*
Leukemia	2528	21	11.7	1.80	(1.11, 2.75)*
Liver	2524	13	6.8	1.91	(1.02, 3.27)*
	2543	13	5.7	2.29	(1.22, 3.91)*
Lymphoma	2531	≤5	<15.0	0.43	(0.14, 0.99) †
	2543	28	17.7	1.58	(1.05, 2.29)*
Myeloma	2536	≤5	<10.0	0.17	(0.00, 0.97) †
	2540	9	4.1	2.20	(1.00, 4.17)*

*Indicates observed number of cancer cases is statistically significantly **higher** than expected
†Indicates observed number of cancer cases is statistically significantly **lower** than expected
‡For observed case counts less than five, numbers have been suppressed to protect confidentiality